

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,
please do not report the images to the
Image Problem Mailbox.**

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau



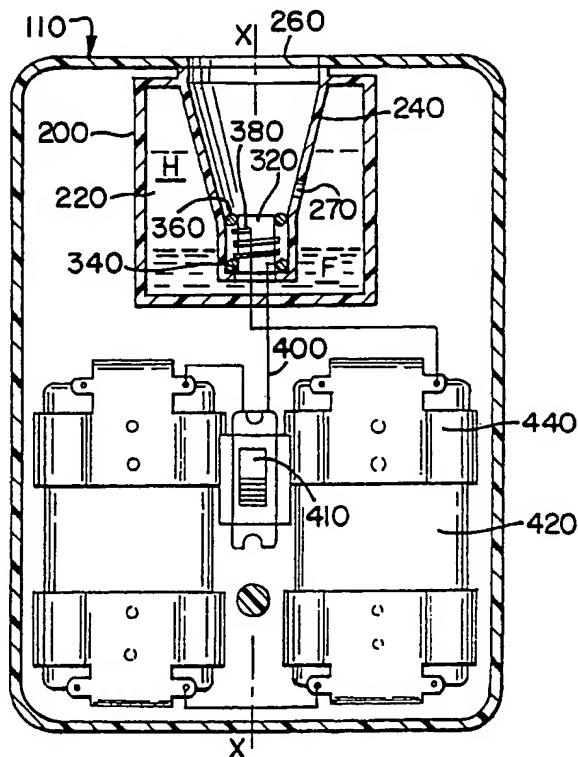
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : B01J 7/00		A1	(11) International Publication Number: WO 90/13359 (43) International Publication Date: 15 November 1990 (15.11.90)
(21) International Application Number: PCT/US90/01593			(74) Agents: DRABIAK, Jerome, D. et al.; S.C. Johnson & Son, Inc., Patent Section M.S. 077, 1525 Howe Street, Racine, WI 53403-5011 (US).
(22) International Filing Date: 22 March 1990 (22.03.90)			
(30) Priority data: 345,340 28 April 1989 (28.04.89) US			(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), IT (European patent), LU (European patent), NL (European patent), SE (European patent).
(71) Applicant: S.C. JOHNSON & SON, INC. [US/US]; Patent Section, M.S. 077, 1525 Howe Street, Racine, WI 53403-5011 (US).			
(72) Inventors: BENTLEY, Jeffrey, Morton ; 20 Landmark Road, Westford, MA 01886 (US). BIRKETT, James, Davis ; R.R.1, Box 412, Mableboro, ME 04555 (US). TAM, Roy, Siu, Wai ; 22A Gibson Way, Saffron Walden, Essex CB10 1AH (GB). MARTIN, John ; 5305 Santa Anita Drive, Racine, WI 53402 (US). WEFLER, Mark, E. ; 4915 Vrana Lane, Racine, WI 53405 (US).			Published <i>With international search report.</i>

(54) Title: PORTABLE VAPOR-DISPENSING DEVICE

(57) Abstract

A portable vapor-dispensing device is disclosed. The device comprises a housing (110), a fluid reservoir (200) for containing an evaporable fluid substance ("F"), a heating means, and a plume-emitting chimney (240). The heating means comprises a heating element (380) and a fluid passageway (320) which communicates with the fluid reservoir (200) and the plume-emitting chimney (240) and which provides a fluid-evaporation zone for the evaporable fluid substance ("F"). The fluid passageway (320) is disposed within the plume-emitting chimney (240). The heating element (380) is externally carried by the fluid passageway (320) and is disposed about the fluid-evaporation zone. The heating element, when energized, causes heat to pass radially through the sidewall of the fluid passageway (320), which in turn causes evaporation of the evaporable fluid substance ("F") from the fluid-evaporation zone. The chimney (240) emits a plume of the thus-evaporated substance, thereby providing an envelope of vapor about the portable device.



DESIGNATIONS OF "DE"

Until further notice, any designation of "DE" in any international application whose international filing date is prior to October 3, 1990, shall have effect in the territory of the Federal Republic of Germany with the exception of the territory of the former German Democratic Republic.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	ES	Spain	MC	Monaco
AU	Australia	FI	Finland	MG	Madagascar
BB	Barbados	FR	France	ML	Mali
BE	Belgium	GA	Gabon	MR	Mauritania
BF	Burkina Fasso	GB	United Kingdom	MW	Malawi
BG	Bulgaria	GR	Greece	NL	Netherlands
BJ	Benin	HU	Hungary	NO	Norway
BR	Brazil	IT	Italy	RO	Romania
CA	Canada	JP	Japan	SD	Sudan
CF	Central African Republic	KP	Democratic People's Republic of Korea	SE	Sweden
CG	Congo	KR	Republic of Korea	SN	Senegal
CH	Switzerland	LI	Liechtenstein	SU	Soviet Union
CM	Cameroon	LK	Sri Lanka	TD	Chad
DE	Germany, Federal Republic of	LU	Luxembourg	TG	Togo
DK	Denmark			US	United States of America

PORTABLE VAPOR-DISPENSING DEVICE

Technical Field

The present invention is generally directed to a device
5 that is specifically designed to contain and to vaporize a
volatile fluid.

The present invention, more particularly, is directed to
a vapor-dispensing device that is portable.

Such a portable vapor-dispensing device is utilized to
10 vaporize an effective amount of at least a portion of a
volatile fluid, such as an evaporable liquid insecticide or
an evaporable insect repellent. The portable device of the
present invention, moreover, is specifically designed to
provide an evaporated-fluid vapor envelope around a user of
15 the device. Thus, the portable device of the present
invention can e.g. provide either an envelope of insecticidal
vapor or an envelope of insect-repellent vapor, respectively,
around such a user for insect-elimination or insect-
repellency purposes.

20 Background Art

Certain biting insects, such as mosquitos and gnats (to
name a few), have for a long time been a bothersome problem
to mankind in general. This has been especially noticeable
in the pursuit of a variety of outdoor activities.
25 Accordingly, a wide variety of commercial products and
insect-elimination methods have been proposed, for the
purpose of eliminating and/or repelling these bothersome
types of insect pests.

For example, a wide assortment of well-known commercial
30 products are presently available, whereby a consumer can
apply an insecticidal or insect-repellent cream, lotion or
spray directly onto him/herself or another. Also available
to consumers are aerosol-dispensable insecticidally-active
and/or insect-repellent sprays for spraying a specific
35 environment. Still further, a wide assortment of well-known
stationary electrically-powered insecticidal devices as well
as insect-repellent foggers are presently commercially
available, for providing an insecticidal or insect-repellent
fog for a specific environment.

While such products and methods of eliminating and/or repelling insects have been found to be useful in certain "limited" situations and/or environments, there is presently a need for an insecticidally-active and/or insect-repelling 5 vapor-dispensing device that is "portable" in the sense that it is readily able to be carried on the user's person, or readily able to be moved to a particular user location, for the specific purpose of eliminating and/or repelling most insects in general and bothersome insect pests, such as 10 mosquitos and gnats, in particular.

Such a portable vapor-dispensing device: must be easy to carry; is preferably relatively light-weight; must be self-sufficient; must effectively contain the insecticidally-active and/or insect-repellent liquid ingredient (and thus 15 not allow the contained insecticidally-active or insect-repellent liquid ingredient to escape); must be so designed as to preclude contact of such an ingredient with the person of the user; must be simple to use; and, most importantly, must provide effective insect-elimination and/or insect- 20 repellency zones or regions in the immediate vicinity of the user.

The prior art briefly reviewed and discussed hereinbelow does not disclose or even suggest a vapor-dispensing device, such as is disclosed herein, which is capable of vaporizing a 25 volatile biologically-active fluid, such as an evaporable insecticidally-active and/or an evaporable insect-repellent ingredient, in accordance with the principles of our invention.

Indeed, one particularly notable aspect or feature of 30 our present invention is directed to the controlled vapor-release of a preselected insecticidal or insect-repellent volatile liquid composition. Accordingly, one of the benefits of utilizing our device is that insect repellency and/or insect elimination can be achieved without direct 35 application of such a biologically-active ingredient directly onto the skin of a user.

In contradistinction, many of the prior-art references which we reviewed disclose devices for vaporizing a wide assortment of evaporable substances. Most of these

evaporable substances, however, do not possess those biologically-active physical properties mentioned immediately hereinabove. For example, disclosed in U.S. Pat. Nos. 1,968,509 to Tiffany and 2,057,353 to Whittemore, Jr., are 5 evaporable, liquid-medicament substances for inhalation. Furthermore, certain other prior-art references, such as U.S. Pat. Nos. 4,106,698 to Lin and 4,609,245 to Sakschek, disclose vaporizers adapted to be worn directly on the person for release of a preselected fragrance or scent, either for 10 the purpose of "masking" from wild animals the odor of a human or for the purpose of attracting wild animals. No such prior-art vaporizer device of which we are presently aware, however, has been found useful for purposes of providing an effective insecticidally-active or insect-repellent vapor 15 envelope in the immediate environment or region of its wearer.

Still further, while each of U.S. Pat. Nos. 4,163,038 and 4,171,340, both to Nishimura et al., as well as U.S. Pat. Nos. 4,228,124 to Kashihara et al., and 4,663,315 to Hasegawa 20 et al. disclose a variety of fumigating apparatuses, no prior-art reference reviewed by us discloses or even suggests a device which possesses the portable, virtually spill-proof aspects and/or features that we disclose herein.

In particular, one such notable aspect or feature of our 25 present invention is its design and construction whereby a volatile, biologically-active ingredient such as an evaporable liquid insecticide or an evaporable liquid insect repellent is effectively contained yet prevented, by the unique design and construction of our device, from spilling 30 therefrom.

Our present invention thus provides a portable, virtually spill-proof fluid-containment device for effectively containing and vaporizing a volatile biologically-active ingredient such as an evaporable liquid 35 insecticide or an evaporable liquid insect-repellent composition. Vaporization of such a volatile compound, moreover, is in a manner so as to provide an effective envelope of active ingredient-containing vapor around the wearer or user of the device. Such a vapor envelope is

effective for purposes of causing either insect elimination (e.g. via insect death), insect repellency, or both.

Summary Disclosure of Invention

Accordingly, the present invention relates to a portable 5 vapor-dispensing device specifically adapted either to be carried on the clothing of a user, or to be moved to the immediate vicinity of such a user, for vaporizing a volatile, biologically-active fluid such as an evaporable liquid insecticide or an evaporable liquid insect repellent.

10 The vapor-dispensing device of our invention, in general, comprises a housing; and a substantially spill-proof fluid reservoir, defined by the housing, for containing a volatile fluid. The vapor-dispensing device includes heating means, within the housing, for vaporizing at least a portion 15 of the vaporizable, reservoir-contained fluid; and a plume-emitting chimney, also defined by the housing, for enabling vaporized, volatile-fluid vapors to evolve from the housing and to form a vapor envelope about the housing.

20 The plume-emitting chimney is preferably flared in a manner so as to prevent condensation on the inner chimney walls. The fluid reservoir preferably contains a volatile, biologically-active fluid such as an evaporable insecticidally-active liquid or an evaporable insect-repellent liquid or a biologically-active fluid which is 25 known to possess both insecticidal as well as insect-repellent properties. (See, e.g., U.S. Pat. No. 4,663,346 to Coulston et al.)

20 The heating means, more particularly, comprises a heating element, and a hollow fluid passageway which 30 communicates with the fluid reservoir and the plume-emitting chimney and which provides a fluid-evaporation zone.

The vapor-dispensing device further includes means for energizing the heating element.

35 The hollow fluid passageway is disposed within the plume emitting chimney. The heating element is externally circumferentially carried by the hollow fluid passageway and is circumferentially disposed about the fluid-evaporation zone.

When a volatile, biologically-active fluid is present in the fluid-evaporation zone and is heated by the heating element, a biologically-active vapor is released from the device via the chimney thereof, thereby providing an envelope 5 of biologically-active vapor, such as an envelope of insecticidally-active and/or insect-repellent vapor, around a wearer or user of the device.

The substantially spill-proof feature of the fluid reservoir of our present invention, moreover, has been 10 observed to virtually eliminate the likelihood of the occurrence of spillage of the fluid from the device, and thereby substantially reduces the likelihood that such fluid will ever come into direct contact with the user, regardless as to whether the device is tipped a bit, or totally 15 inverted, relative to an initial vertical position. This particular aspect or feature of our present invention has been deemed to be of importance when the device is e.g. used in a rigorous outdoor activity such as hiking.

Industrial Applicability

20 While the above summary briefly discusses one particular embodiment of our present invention, such embodiment being specifically designed to be worn by a user, it will be appreciated by those skilled in the art that our invention can readily be incorporated into other types of movable 25 vaporizer devices such as those types of vaporizers which are designed to be placed on table tops, counter tops, desks, night stands, and like locations.

As previously mentioned, one notable aspect or feature 30 of our present invention is the substantially spill-proof nature of the fluid reservoir thereof. This aspect or feature of our present invention is also particularly useful in still other portable vapor-dispensing devices embodying the principles of our present invention, such as those above-mentioned vapor-dispensing devices which are designed to be 35 placed on a table top and like locations. Indeed, such table top-placed or similarly-located types of devices thus allow for convenient transporting of the vapor-dispensing device of our invention to the environment of use without experiencing

spillage of the contained vaporizable fluid from the device while en route.

Accordingly, one object of the present invention is to provide a portable vapor-dispensing device able to be carried 5 on the person of a user, or able to be moved in connection with the needs of a user. The device is specifically designed for vaporizing a biologically-active volatile fluid such as an evaporable liquid insecticide or an evaporable liquid insect repellent. Upon vaporizing at least a portion 10 of such a volatile fluid, a biologically-active vapor is released from our portable device. Release of such a biologically active vapor from our device is in a manner so as to provide an envelope of active ingredient-containing vapor around the user for the purpose of eliminating and/or 15 repelling insects.

Yet another object of the present invention is to provide a portable, vapor-dispensing device for vaporizing a volatile biologically-active fluid -- such as an evaporable liquid insecticide or an evaporable liquid insect repellent 20 -- utilizing conduction-heating principles. Such a device, in particular, further includes a substantially spill-proof fluid reservoir for containing the volatile fluid. The device, still more particularly, is so constructed as to preclude leakage and/or spillage of the fluid from the fluid 25 reservoir thereof. The device is thus specifically so constructed as to prevent the contained volatile fluid from coming into direct contact with the person of the user.

A further object of the present invention is to provide a portable, volatile fluid-containing, vapor-dispensing 30 device which can readily be utilized by a user for the purpose of vaporizing the contained volatile fluid, wherein such device may controllably be turned "on" (i.e., its heating element is energized) and turned "off" (i.e., its heating element is de-energized) by the user, as desired, 35 when conditions require, so as to provide for maximum use and efficiency of the thus-contained volatile fluid.

A still further object of the present invention is thus to provide a self-sufficient, portable vapor-dispensing device which is able to provide a biologically-active vapor

- 7 -

envelope, effective for causing insect elimination and/or repellency on demand without the need for applying the biologically-active ingredient directly onto the person of the user.

5 Yet another object of the present invention is to provide a portable vapor-dispensing device readily capable of being carried on the person of the user, or readily capable of being moved to the immediate vicinity of the user, wherein such a portable device is relatively light weight, simple and
10 safe to use, inexpensive to manufacture, and wherein such a device will generally provide for substantial and effective insect elimination and/or repellency from a particular zone or region.

A still further object of our present invention is to
15 provide a self-sufficient, portable, vapor-dispensing device for use in an environment in the immediate vicinity of a user, such as on a table top or a similar location that is in close relation to the user, for the purpose of providing a vapor envelope, upon vaporizing a biologically-active
20 volatile liquid such as an evaporable liquid insecticide or an evaporable liquid insect repellent, whereby an insecticidally-active or insect-repellent vapor is caused to be released from the device in a manner so as to cause, in turn, the elimination and/or repellency of insect pests.

25 These and other objects of the present invention will become apparent to those skilled in the art upon reading the following description of the presently preferred embodiments and upon referring to the accompanying drawing figures therefor.

30 Brief Description of the Drawing Figures

In the accompanying drawing figures,

FIGURE 1A is a front perspective view of one embodiment of the invention;

FIGURE 1B is a rear perspective view of the embodiment shown in FIGURE 1A;

FIGURE 2 is a vertical cross-sectional view, taken generally from the plane 2-2 shown in FIGURE 1A;

FIGURE 3 is another vertical cross-sectional view, taken generally from the plane 3-3 shown in FIGURE 1A;

FIGURE 4 is a vertical cross-sectional view, on an enlarged scale relative to FIGURES 2 and 3, showing one embodiment of the chimney and heating element briefly mentioned hereinabove;

5 FIGURE 5 is an electrical schematic diagram, on no particular scale, showing the electrical circuitry of that embodiment shown in FIGURES 2 and 3;

FIGURE 6 is a perspective view of the device of FIGURE 1A, on a reduced scale relative thereto, showing the 10 invention in use in a manner so as to provide an envelope of biologically-active vapor around the person of the user;

FIGURE 7 is a front elevational view of another embodiment of the present invention;

FIGURE 8 is a partially-fragmented vertical cross-15 sectional view, taken generally along the plane 8-8 shown in FIGURE 7;

FIGURE 9 is an upper, perspective view of yet another embodiment of the present invention; and

FIGURE 10 is a partially-fragmented vertical cross-20 sectional view, taken generally along the plane 10-10 shown in FIGURE 9.

Throughout the drawings, like reference numerals refer to like parts.

Best Mode For Carrying Out The Invention

25 While the present invention is susceptible to embodiment in various forms, there are shown in the accompanying drawing figures and hereinafter described in detail a number of presently preferred embodiments of our invention, with the understanding that the present disclosure is to be considered 30 as an exemplification of the present invention without limitation to the specific embodiments illustrated and described herein.

Referring now in detail to the accompanying drawing figures, it will be seen that there is illustrated in FIGURES 35 1A, 1B, and 2 through 6 one embodiment of a portable vapor-dispensing device, capable of being carried on the person of the user, in accordance with the principles of the present invention. Another embodiment of the present invention, also capable of being carried on the person of the user, is shown

- 9 -

in FIGURES 7 and 8. A further embodiment of the invention, readily capable of being moved in connection with the business of the user, is shown in FIGURES 9 and 10.

Referring now initially to FIGURES 1A, 1B, and 2 through 5 6, the portable vapor-dispensing device 100 of the invention includes a housing 110 which comprises a front housing section 120 and a rear housing section 140 joined together by suitable fastening means such as threaded fastener 150 (FIGURE 2).

10 The housing 110 can be made of any suitable, light-weight material such as a wide variety of commercially-available plastics that are produced by conventional processes and known to those skilled in the art. Any plastic housing material that is selected, however, must of course be 15 compatible with the particular biologically-active volatile fluid that is to be vaporized. In a preferred embodiment, the housing sections 120 and 140 are made of a commercially-available polycarbonate material manufactured by known injection molding methods. The housing 110 of the embodiment 20 shown in FIGURE 1A can thus be of any suitable dimension such that it may be carried on the belt, or inserted in the shirt pocket of the user, whichever is desired. It has been found that one such housing having the following dimensions is generally suitable for both of these purposes: a depth of 25 about 1 and 1/4 inches, a height of about 3 and 1/2 inches, and a width of about 2 and 1/2 inches.

Attached to the device 100, preferably to the rear section 140 of the housing 110, is a clip 160 (FIGURES 1B and 2) which allows the device 100 to be carried directly on the 30 clothing of the user. Such a clip 160, moreover, enables the device 100 to otherwise be located in close relation to the user. For example, the device 100 can be attached directly to the belt 170 of the user, as is shown in FIGURE 6, or the device can be attached to an article in close relation to the 35 user, such as a tent flap, a backpack or a handbag (the three, last-mentioned arrangements not being shown herein).

Referring now, in particular, to FIGURES 2 and 3, a reservoir 200 is arranged within the device 100 for containing a volatile fluid "F", preferably biologically-

active, such as an evaporable liquid insecticide or an evaporable liquid insect repellent. The illustrated fluid reservoir 200, which is shown as being unitary with the front housing section 120 (FIGURE 2), is specifically so designed 5 and dimensioned as to enable the device 100 to be substantially spill-proof even when the device 100 is tipped sideways or inverted relative to an initial vertical position, as will be more completely described in greater detail below.

10 In one preferred embodiment of our present invention, fluid reservoir 200 is either transparent or translucent, and the front housing section 120 includes a window 180 (FIGURE 1A) which functions as a visual indicator of the amount of vaporizable liquid "F" remaining in the device 100.

15 As was briefly mentioned above, the fluid reservoir 200 is so formed as to be an integral part of the front housing section 120. Those skilled in the art can appreciate that the fluid reservoir can thus be formed by utilizing conventional molding processes such as known injection-20 molding techniques. Otherwise, the fluid reservoir can be so formed as to be an integral part of the rear housing section, if desired (such embodiment not being shown herein).

Alternatively, the reservoir may be separately formed and then attached to either or both of the housing sections.

25 In the latter case, the reservoir can readily be so adapted as to be replaceable within the housing, thereby allowing for the replacement of such a reservoir after desired vaporization of the contained fluid which, in turn, would further allow for the interchanging of a variety of like-30 dimensioned reservoirs containing a wide variety of vaporizable liquid substances. Accordingly, the portable vapor-dispensing device of the invention can be so constructed as to be readily re-usable, as will be appreciated by those skilled in the art.

35 Referring to FIGURE 2, it can be seen that reservoir 200, thus disposed within an upper portion of housing 110, defines a fluid chamber 220 for receiving and containing the vaporizable fluid "F". Integrally depending from an internal upper portion of fluid reservoir 200 is a

frusto-conical-shaped funnel-like plume-emitting chimney member 240 which provides a means for release of the vaporized fluid from the device 100. In particular, such vapor release is through upper opening 260, defined by the 5 upper portions of front and rear housing sections 120 and 140 (FIGURES 1A and 1B), to the environment of use.

The chimney member 240 defines a longitudinal axis X-X (FIGURES 1A, 1B and 4). Such a plume-emitting chimney 240 is preferably flared outwardly by at least 15 degrees (FIGURE 10 4), relative to the longitudinal axis X-X, to prevent liquid condensation on the inner chimney walls. It is to be understood that the housing 110 is preferably so constructed and arranged as to provide the upper opening 260 of chimney 240 along the upper portion of the device 100 (FIGURE 2) to 15 thus allow vaporized, volatile-fluid vapors to evolve from the uppermost portion of device 100.

At the base of chimney 240 is a lower, annular ledge 250 (FIGURE 4) which defines a lower opening 265 for chimney 240. Chimney 240, moreover, is so constructed and arranged as to 20 removably retain a heating means or assembly 300. For example, annular ledge 250, which is generally radially inwardly disposed along the lower, inner circumferential edge portion of plume-emitting chimney 240, is utilized to enable heating assembly 300 to be removably disposed within the 25 lower portion of chimney 240.

An air vent 270 is positioned through the wall of chimney 240 for providing ventilation of the fluid reservoir 200. It is understood that vent 270 is so constructed and arranged through the sidewall of chimney 240 30 and along the longitudinal axis X-X such that the evaporable fluid "F" in fluid reservoir 200 will not escape through the vent 270 if the device 100 is tipped sideways or inverted relative to the vertical.

Heating assembly 300 comprises a hollow fluid passageway 35 or tube 320 which communicates with the fluid chamber 220 and the chimney 240 (FIGURES 2 and 3). Because of this fluid communication between tube 320 and fluid chamber 220, the liquid level of evaporable fluid "F" within tube 320 is at the liquid level of evaporable fluid "F" in fluid

chamber 220. Lower and upper O-rings 340 and 360, disposed within the base portion of chimney 240 (FIGURE 4), are so dimensioned relative to the internal dimensions of chimney 240 and the external dimensions of tube 320 as to 5 provide the fluid communication between tube 320 and fluid chamber 220 (mentioned above) and also so as to provide an air gap "A" within the annular region between tube 320 and the chimney lower walls 275 (FIGURE 4). Lower O-ring 340 is seated on annular ledge 250 and also functions as a seal to 10 prevent leakage of the evaporable fluid "F" from fluid chamber 220. Tube 320 is thus held in place within chimney 240 by O-rings 340 and 360.

The heating assembly 300 further comprises a heating element that is externally circumferentially carried by the 15 fluid passageway or tube 320 and that is circumferentially disposed about the evaporable fluid level in tube 320. It is to be understood that the properties of the fluid passageway or tube 320 are such that it is an electrical insulator. The heat-transfer characteristic of the fluid passageway or tube 20 320, moreover, is preferably such that a minimal amount of heat passes through the wall of tube 320 in the axial direction (i.e. along axis X-X), and further, such that most of the heat produced by the heating element is conducted radially through the wall of tube 320 into the evaporable 25 fluid contained therein. Circumferentially wrapped about the exterior of tube 320 is an electric wire coil assembly 380 (FIGURE 4) which thus provides heat to the evaporable fluid "F" within heating tube 320. It is desirable that hollow fluid passageway or tube 320 be as thin-wall as possible.

30 The heating assembly 300 thus comprises a tube 320 constructed of a suitable heat-conducting thin-wall material such as glass tubing having an inner diameter, preferably, of between 0.030 and 0.060 inches, and preferably, about 1 millimeter or less in wall thickness.

35 Within the scope of the present invention, it is contemplated that such a heating element can for example be made of carbon or a like electricity-conducting material, or can be made of an electricity-conducting semi-conductor material which is able to generate heat as a result of

electrical current being passed therethrough. Thus, it is contemplated that suitable electricity-conducting materials could for example be electro-deposited or vapor-deposited onto the outer surface of a suitable hollow fluid passageway 5 or tube.

For purposes of illustration, electric wire coil assembly 380, one such heating element, is shown in FIGURE 4 as being loosely circumferentially wrapped about tube 320. It is to be understood, however, if such an electric wire coil 10 is utilized as such a heating element, that the wires of such a loop should be of as thin a wire as is possible. Also, the loops of such a wire should be as tightly wound about the exterior of tube 320 and as close to the actual liquid level in tube 320 as is possible. Lastly, such wire loops should 15 preferably be so circumferentially carried by tube 320, relative to longitudinal axis X-X, as to radially conduct heat into a fluid evaporation zone, defined by and contained within tube 320, which begins approximately at the evaporable-fluid level in tube 320 and which extends 20 downwardly by about 1/2 millimeters therefrom.

Ideally, and in accordance with the principles of our invention, the fluid reservoir 200, which is in fluid communication with tube 320 (FIGURES 2 and 3), is so designed as to provide a fluid-evaporation zone which substantially 25 remains fixed at a predetermined point along the longitudinal axis X-X, when the device 100 is tipped by as much as 35 degrees relative to the vertical and while the contained volatile fluid "F" is being vaporized. (In this regard, it is to be understood that only a relatively minor amount of 30 the initially-contained volatile fluid, i.e. only about 2 to about 8 volume percent, actually vaporizes during the useful life of the portable device 100.) Further, the fluid reservoir 200 is designed such that a major portion of the total volume of the volatile fluid is contained within that 35 void space which is exterior of the chimney 240, with a minor portion of the total volume of the contained volatile fluid being present in the fluid evaporation zone. Still further, the fluid reservoir 200 is so designed as to possess sufficient headspace "H" as to provide sufficient volume

(FIGURES 2 and 3) for effectively containing the evaporable fluid "F", with virtually no loss of evaporable fluid "F" from the device via the chimney 240, when the device 100 is totally inverted relative to the vertical. (The axial 5 location of the above-mentioned air vent 270 through the wall of chimney 240, relative to the longitudinal axis X-X of the vapor-dispensing device 100, is of course a design consideration in this regard.) The fluid reservoir 200, shown in FIGURES 2-4, is thus illustrative of these various 10 principles of the present invention.

Coil assembly 380, operatively connected to a power source, is caused to heat up by the passage of a suitable amount of electric current therethrough. As the coil assembly 380 heats up, heat thus passes from coil 15 assembly 380 through tube 320 and thereafter into the vaporizable fluid which is contained in the fluid-evaporation zone within tube 320. The wire coil assembly 380 is connected by conventional, electrical current-conducting wire means 400 (FIGURES 2 and 3) to an electric switch and energy 20 source, in this case, respectively, switch 410 (FIGURES 1A and 5) and batteries 420 (FIGURES 2 and 3). Batteries 420 are held in place by conventional battery support means 440. The batteries 420 are operatively connected to the electric switch 410 in a conventional manner for activating and de- 25 activating the device 100 as desired.

A means for energizing the heating means or assembly 300 is thus preferably arranged within the housing 110 of the device 100. In a preferred embodiment of our invention, batteries 420 (mentioned above) are used for such a purpose. 30 While batteries are the preferred energy source, it should be understood that other energy sources may also be used. For example, those skilled in the art can appreciate that certain electrical-circuitry changes can be made so as to utilize house current as a power source, in lieu of batteries, if 35 desired. Alternatively, solar cells could be utilized as a power source, if desired.

Referring to FIGURE 5, there is shown one preferred embodiment of an electric schematic, embodied within our portable vapor-dispensing device. Specifically, our

device 100 incorporates a portable voltage source, such as the above-mentioned batteries 420. The voltage source is controlled by an on/off switch, such as the illustrated switch 410. The device 100 is also preferably provided with 5 a variable resistor 450 for the purpose of controlling heating of the coil assembly 380 (FIGURE 4) which is represented in FIGURE 5 by resistor 460. Thus, regardless of whether the contained vaporizable fluid substance has a low or high boiling-point temperature, the fluid temperature 10 within the fluid-evaporation zone can be controlled so as to provide a desired rate of evaporation of the contained fluid substance. The wires 410 will, of course, have a suitable cross sectional area for such a purpose. The resistance of the remainder of the circuit is represented in FIGURE 5 by 15 resistor 470. The electric system thus further preferably includes variable resistor 460 which represents the heating coil 380 and another resistor 470 which represents the remainder of the electrical circuit, including the wires 400 shown in FIGURES 2 and 3. Thus, the heat passing through the 20 heating coil 380 can readily be controlled to thereby control the evaporation rate of the vaporizable fluid within the fluid-evaporation zone. For example, in an enclosed area, such as a tent, it may be desirable to evaporate the vaporizable fluid slowly, so as to provide an effective 25 insecticidal or insect repellent envelope, without causing breathing discomfort to the occupants of the enclosed area. On the other hand, in an open area, particularly where there is a breeze, it will be desirable to evaporate the vaporizable fluid much more rapidly, for purposes of 30 providing an effective envelope of insecticidal or insect repellent vapor.

Thus, in operation, when the switch 410 of the portable vapor-dispensing device of the invention is set in the "on" position, heating coil 380 provides heat to passageway or 35 tube 320. The vaporizable fluid "F" enters passageway or tube 320, via its underside, and is heated by conduction heating; and the volatile fluid substance which is vaporized by the thus-conducted heat is released to the environment through upper opening 260 of chimney 240.

As set forth above, a primary use of the invention is for providing an envelope of insecticidal or insect repellent fog around the user. Those skilled in the art can appreciate, moreover, that the portable device of our present 5 invention can be used to evaporate medicinal compositions, or water for medicinal or health purposes, for example, if desired.

Those insecticidal or insect-repellent evaporable fluids which are useful in our present invention are limited only to 10 the extent that such fluids are vaporizable, are of a composition which is capable of forming a vapor of sufficient density to provide an envelope of insecticidal or insect repellent vapor around the user, and are non-toxic.

The density of the insecticidal or insect repellent 15 vapor required will depend on a variety of factors. For example, in an enclosed area a less dense fog or envelope will be required. Whereas in a breezy environment, a rather dense fog or envelope might be preferred.

A preferred volatile insecticidal fluid substance is 3-20 allyl-2-methylcyclopenta-2-ene-4-one-1-yl di-cis/trans-chrysanthemate, sold under the brand name "Pynamin-forte" by Sumitomo Chemical Co., Ltd. of Japan. A preferred volatile insect-repellent fluid substance is N,N-diethyl meta-toluamide (commonly known as deet).

25 The portable device of the present invention can also be utilized to evaporate other evaporable fluid substances such as evaporable fluid antiseptics, evaporable fluid agricultural fungicides, evaporable fluid plant-growth regulators, evaporable fluid herbicides, and the like. See, 30 for example, U.S. Pat. No. 4,163,038 to Nishimura et al, which is herein incorporated by reference. Additional insecticides and insect repellents useful in the present invention are disclosed in U.S. Pat. No. 4,163,038.

While a primary object of the invention is to provide 35 for a portable insecticidal or insect repellent vapor-dispensing device, it should be understood, as was briefly mentioned above, that still other vaporizable fluids are contemplated within the scope of our present invention, such

as air fresheners, perfumes, deodorants, medicaments, and the like.

Another embodiment of our present invention is shown in FIGURES 7 and 8 wherein our invention is so constructed as to 5 be carried, for example, in or attached to a pocket of the user. Specifically, a portable dispenser 500 comprises a directional swivel head 520, a barrel portion 540, a cap portion 560, a clip 580, and an electric on/off switch 600. This embodiment of our invention is powered by penlight 10 batteries 620 and includes a fluid reservoir 640 constructed similar to that of the fluid reservoir 200 in the embodiment of FIGURES 1A, 1B, and 2 through 6. That is, air vent 770 is so located along the sidewall of chimney 740 as to provide a substantially spill-proof fluid reservoir. Swivel head 520 15 allows the user to choose the direction in which the vapor envelope is released and includes a grill 650, carried by the directional swivel head 520, for providing a more defined release of the vaporized fluid substance. As in the first embodiment previously discussed, the fluid reservoir 640 of 20 the portable vapor dispensing device 500 may be constructed to be either disposable or non-disposable.

In operation, penlight batteries 620 cause electrical wire coil assembly 780 to heat up. Heat is transferred via tube 720 into the fluid-evaporation zone. Thus-evaporated 25 fluid substance evolves via chimney 740 through grill 650 for providing the desired vapor envelope.

The above-described invention provides for a portable vapor-dispensing device which is inexpensive to manufacture and simple and safe to use. The portable vapor-dispensing 30 device avoids user contact with the liquid insecticide or insect repellent due to the substantially spill-proof reservoir and allows the user to activate and de-activate the device, as conditions require, in order to provide for maximum use and efficiency of the insecticide or insect 35 repellent contained by the device. The formation of an envelope of insecticidal or insect repellent vapor around the user provides a new and useful means of insect elimination and repellency in a convenient and efficient manner.

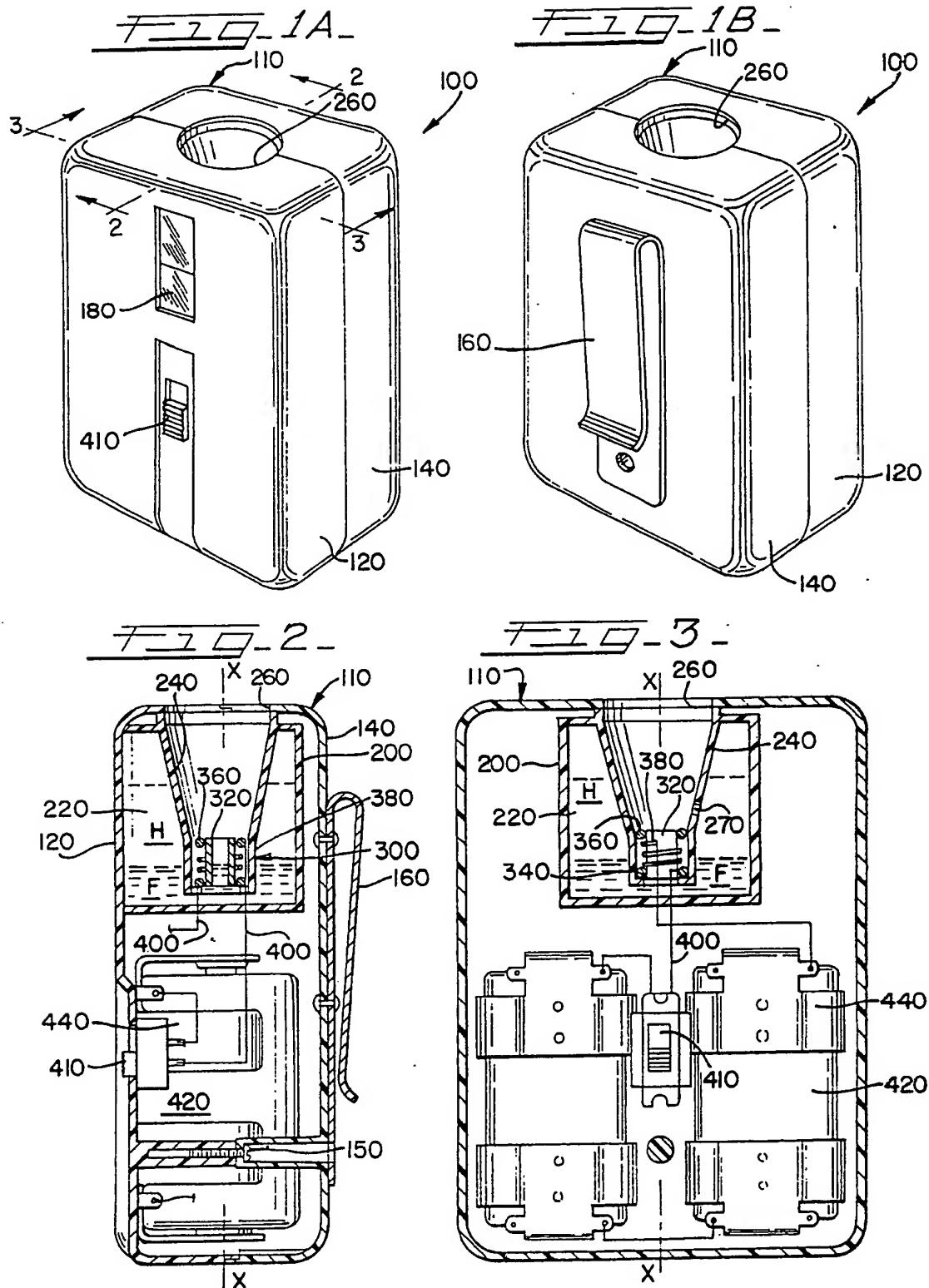
Referring lastly to FIGURES 9 and 10, yet another embodiment of our invention is shown for use in close relation to a user, such as on a table top or the like. More specifically, a portable, self-sufficient vapor dispenser 5 comprises a housing 800 having a top portion 820 and a bottom portion 840 connected by conventional means such as a bayonet-type connecting means. Within housing 800 is a substantially spill-proof fluid reservoir 860 constructed so as to be similar to the above-mentioned fluid reservoir 200 10 of the embodiment of FIGURES 2 and 3. That is, air vent 970 is so located along the sidewall of chimney 940 as to provide a substantially spill-proof fluid reservoir. The substantially spill-proof fluid reservoir 860 is extremely important as it provides an effective means for evaporation 15 of the vaporizable fluid and also provides for the safe transporting of the device to the environment of use without spilling the vaporizable fluid. The device includes a grill 880 for providing defined release of the vapor. Additionally, the device includes a hook 900 for carrying 20 and/or hanging the device. Similar to the embodiments shown in FIGURES 1A, 1B, and 2-8, the device shown in FIGURES 9 and 10 is battery-operated; and upon activation by an electric switch means (not shown) will provide an envelope of insecticidal or insect repellent vapor around the user for 25 insect elimination or repellency.

What has been illustrated and described herein is a portable vapor-dispensing device. While the vapor-dispensing device of the present invention has been described with reference to a number of preferred embodiments, it is to be 30 understood that the present invention is not to be limited thereto. For example, alternatives, changes and modifications will become apparent to those skilled in the art upon reading the foregoing description. Accordingly, such alternatives, changes and modifications are to be 35 considered as forming a part of the present invention insofar as they fall within the spirit and scope of the appended claims. It is to be understood, therefore, that within the spirit and scope of the appended claims the invention may be practiced otherwise than as above-described.

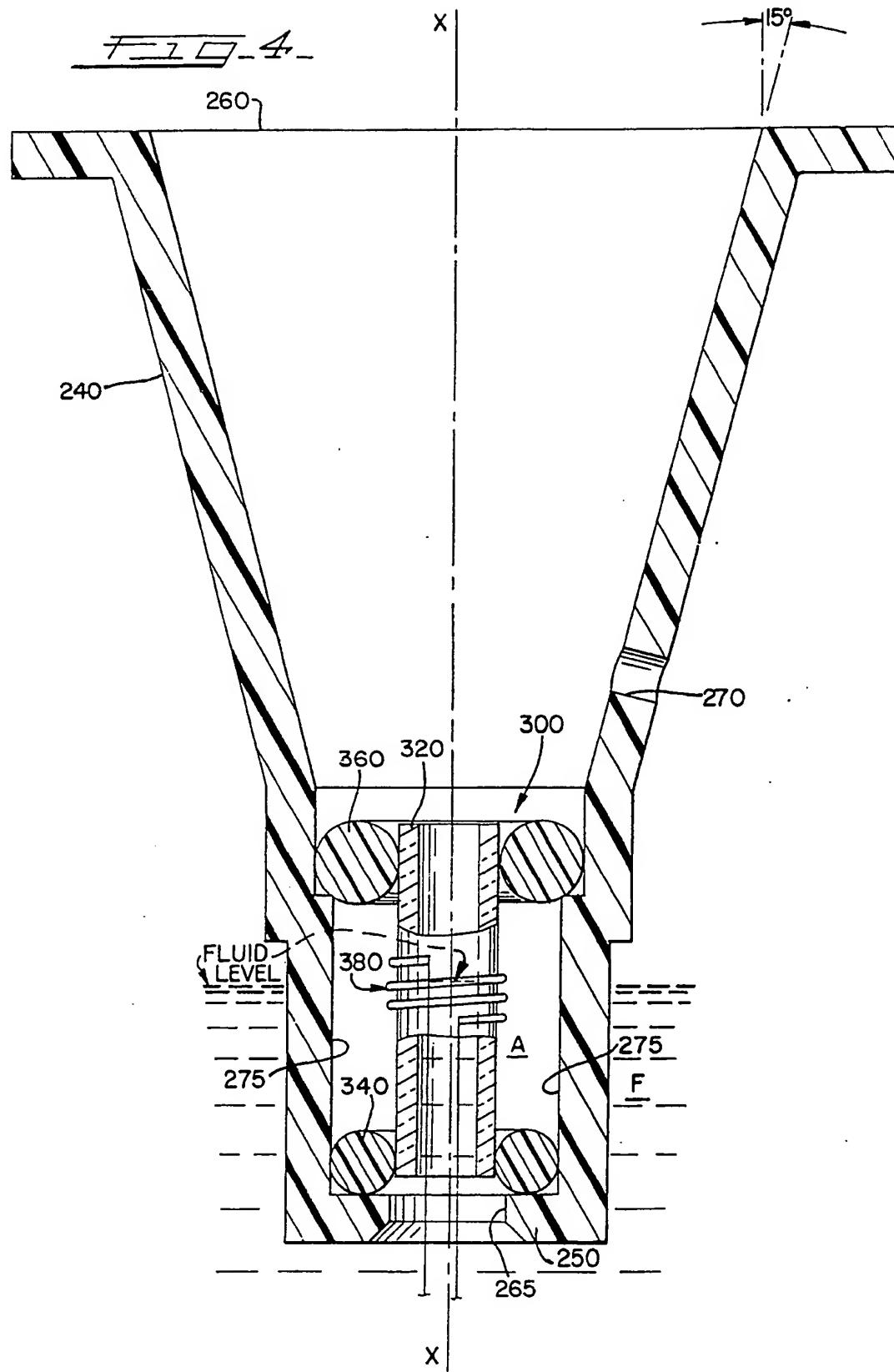
We Claim:

1. A portable vapor-dispensing device comprising:
 - a housing;
 - a fluid reservoir, defined by the housing, for
 - 5 containing a volatile fluid;
 - chimney means, defined by the housing, for enabling vaporized, volatile fluid vapors to evolve from the housing and form a vapor envelope about the housing;
 - heating means disposed within the housing, the heating
 - 10 means comprising a heating element and a fluid passageway which communicates with the fluid reservoir and the chimney means and which provides a fluid-evaporation zone, the heating element being disposed external to the fluid passageway and about the fluid-evaporation zone; and
 - 15 means operatively connected to the heating element for energizing the heating element.
2. The vapor-dispensing device of claim 1 wherein the fluid reservoir contains a predetermined quantity of a biologically-active volatile fluid.
- 20 3. The vapor-dispensing device of claim 2 wherein the biologically-active volatile fluid is insecticidally active.
4. The vapor-dispensing device of claim 2 wherein the biologically-active volatile fluid is insect repellent.
5. The vapor-dispensing device of claim 1 wherein the means
- 25 for energizing the heating element comprises at least one battery.

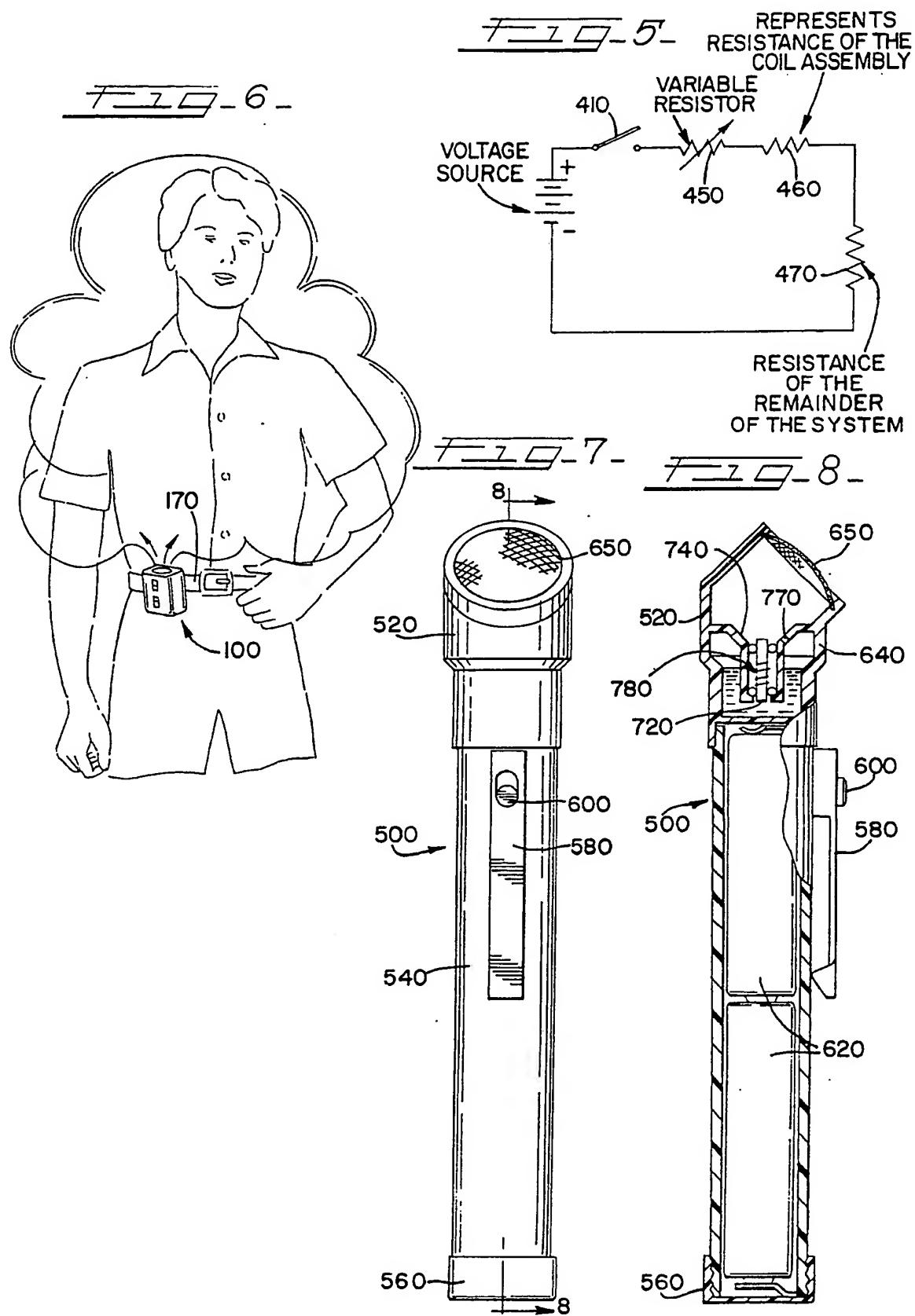
1/4



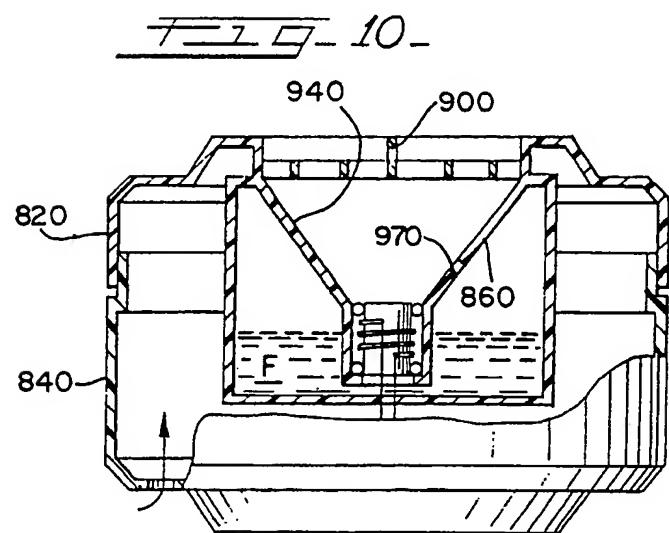
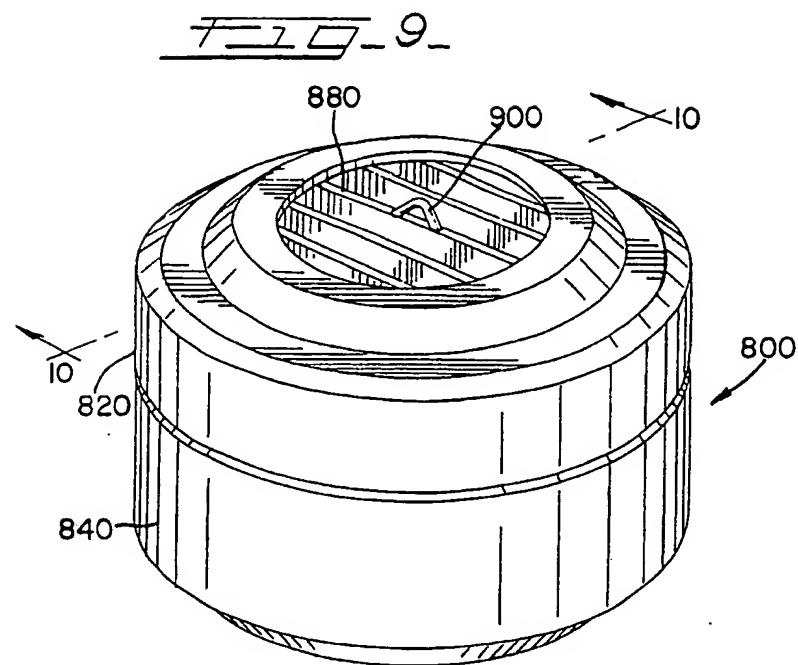
2/4



3/4



4/4



INTERNATIONAL SEARCH REPORT

International Application No. PCT/US90/01593

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(5): B01J 7/00

US CL. 422/305

II. FIELDS SEARCHED

Minimum Documentation Searched ⁷

Classification System	Classification Symbols
US CL.	422/305, 120, 121, 123, 125 239/34, 36

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched ⁸

III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹

Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X Y	US,A, 3,780,260 (ELSNER) 18 December 1973 See entire document	1 2-5
X Y	US,A, 2,140,516 (COWAN) 20 December 1938 See entire document	1 2-5
X Y	US,A, 2,057,353 (WHITTEMORE) 13 October 1936 See entire document	1 2-5
X Y	US,A, 2,041,219 (WADE) 19 May 1936 See entire document	1-4 5

• Special categories of cited documents: ¹⁰

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search

Date of Mailing of this International Search Report

20 April 1990

12 JUN 1990

International Searching Authority

Signature of Authorized Officer

ISA/US

Timothy M. McMahon